TREND STUDY 1-6-96

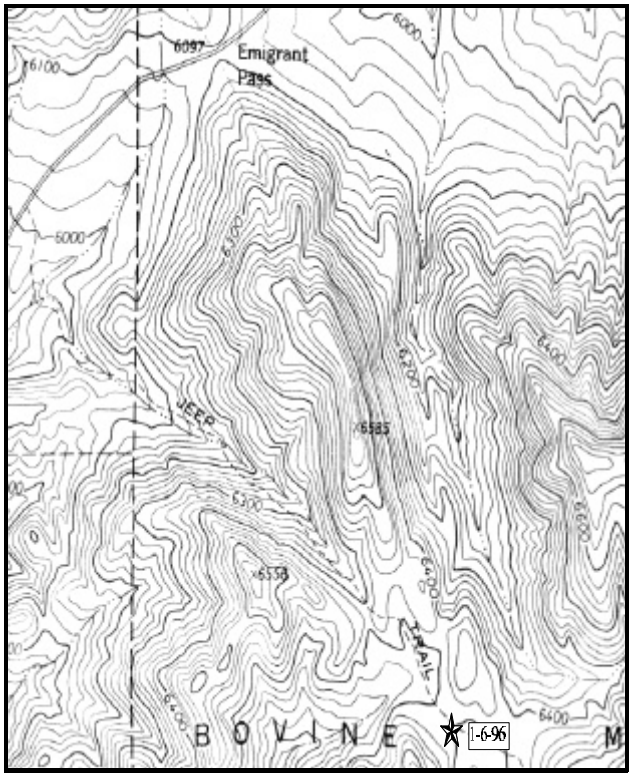
Study site name: Bovine Exclosure . Range type: Sagebrush/grass .

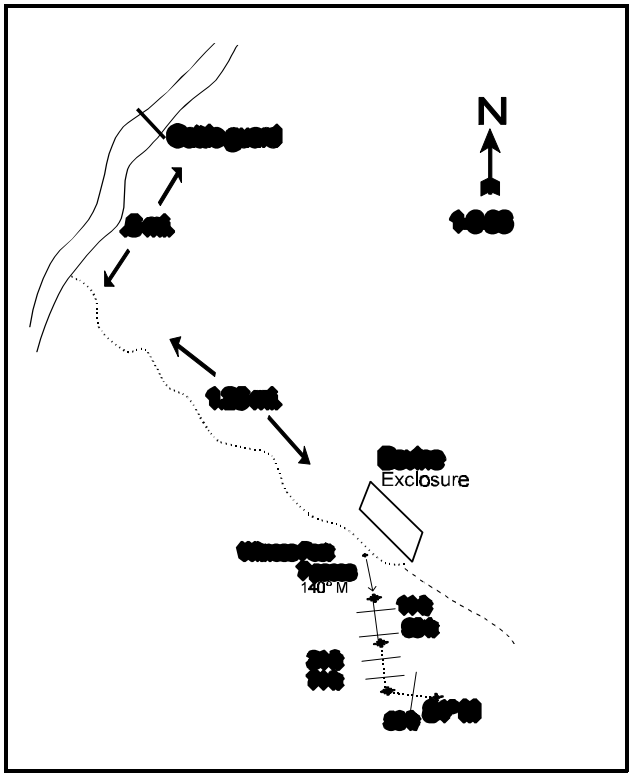
Compass bearing: frequency baseline 180 degrees.

Footmark (first frame placement) 5 feet, footmarks (frequency belts) Line 1 (11 & 95ft), line 2 (34 & 71ft), line 3 (59ft).

LOCATION DESCRIPTION

Proceed south by west to the summit of Emigrant Pass on Emigrant Pass Road. From the cattleguard at the summit, proceed south 0.5 miles to a fork and turn left. Travel 1.25 miles on this road to the Bovine Exclosure where there will be a witness post on the right side of the road. From the witness post, follow an azimuth of 140 degrees magnetic for 7 paces to the 0-foot stake of the frequency baseline. The 0-foot stake is a green, steel fence post marked with browse tag #7909. Bearing of the baseline is 180 degrees true. Line three will change direction to 59° M.





Map Name: Emigrant Pass, Utah Diagrammatic Sketch

Township 9N Range 16W , Section 18 , UTM: 2-72-995E 45-98-194N

DISCUSSION

Trend Study No. 1-6

This study is located immediately adjacent (south) to the Bovine exclosure. Although at a relatively high elevation (6,400 ft.), the study site receives substantial deer use during all but the most severe winters. During the winter of 1983-84, two and a half to three feet of snow covered the area and deer were unable to use the area in midwinter. However, during most years, the area is available and is considered critical deer winter range. Deer use is moderate to occasionally heavy. The site is located in a small "saddle" and thus has only a 5% to 10% percent east-southeast facing slope. Much of the surrounding area is steeper. The range type is sagebrush-grass with scattered or open juniper-pinyon woodland. Point quarter data from 1996 estimate Utah juniper density at 47 trees/acre and singleleaf pinyon at 8 trees/acre. This area is in the White Lakes sheep allotment which is grazed by 1,5000 sheep from December 1 through March 31.

Soil is loose and coarse textured but apparently quite deep, especially on the more level areas. On steeper areas, erosion has resulted in shallower soils with a lot of exposed rock. Effective rooting depth averages 22 to 24 inches along the original baseline. Two additional 100 foot baselines were added in 1996 to increase the sample size. These two baselines are on shallower soils averaging only 12 to 13 inches in depth. Rock cover on the surface is also greater. The parent material appears to be granite, which must contain some subsurface fractures because there are some basin big sagebrush growing on these shallower soils. Ground cover is fair from perennial grasses and litter. Erosion is not currently a problem.

The key browse species, basin big sagebrush, numbered 1,532 plants/acre in 1984 increasing to 3,199 by 1990. Forage production for this sagebrush type was estimated at 2,010 pounds per acre (air dry) with the 1970 range inventory. Extremely heavy vole damage during the 1983-84 winter, killed approximately three-fourths of the big sagebrush and bitterbrush in the area. Other shrub species; black sagebrush, rabbitbrush, stickyleaf low rabbit brush, and Utah juniper experienced considerably less damage. Under more normal circumstances, shrub density, especially that of the more preferred species would be higher. The surviving basin big sagebrush sampled in 1984 were generally in poor vigor with 63% of the population decadent. Decadency was primarily from rodent damage. Browsing by deer was moderate with 20% of the plants heavily utilized. Utilization was light to moderate in 1990, and percent decadency declined to 22%. Conditions are similar as of 1996 with light to moderate use and a decadency rate of 27%. Vigor is good on all but a few decadent plants. During the 1996 reading, dead plants were included in the shrub density estimates. There were approximately 1,700 dead basin big sagebrush per acre. This data provides an idea as to the extent of the 1983-84 die-off. Some of the decadent and dying sagebrush encountered in 1996 appeared to be a result of the extended drought since the late 1980's.

With the extended base line used in 1996, more black sagebrush and bitterbrush were picked up in the sample. Currently there are an estimated 1,360 black sagebrush plants/acre which are lightly hedged and in good vigor. Bitterbrush number about 260 plants/acre with 31% displaying heavy use. Percent decadency of these shrubs is 15% and vigor is generally good.

It was feared that the widespread die off would provide an opportunity for less desirable shrubs such as broom snakeweed and narrowleaf low rabbitbrush to increase. Narrowleaf low rabbitbrush has remained stable since 1984 and broom snakeweed, first sampled in 1996, numbers only 900 plants/acre.

Observations from the nearby livestock exclosure also show a basin big sagebrush die-off. Both the total exclosure and the livestock exclosure show dead and dying plants. Use of the sagebrush in the livestock exclosure was light to moderate while the bitterbrush had a clubbed growth form indicating heavy use.

The herbaceous understory is dominated by native grasses, primarily bluebunch wheatgrass and Sandberg bluegrass. Annual cheatgrass is also abundant and provides 17% of the grass cover. Forb composition features several large showy species and a variety of lower growing forms. Overall forb composition and density are above the average for most juniper-pinyon sites in this area. Important forbs include arrowleaf balsamroot, tapertip hawksbeard, two large Lomatium species, and at least two kinds of milkvetch.

1984 APPARENT TREND ASSESSMENT

Soil trend appears stable even though there are numerous patches of bare ground and erosion pavement. The interspersed herbaceous cover and litter accumulations have acted to prevent serious erosion. The gentle slope is also a factor in this regard. Vegetative trend is down primarily because of widespread rodent damage to the most important browse species. Whether there will be any recovery will become apparent within the next few years. Herbaceous density, however, appears to be high enough to offer some competition to developing shrub seedlings.

1990 TREND ASSESSMENT

Trend for soil is stable. Percent bare ground increased slightly while litter cover declined. However, basal vegetative cover nearly doubled and erosion is not a problem on this site. Trend for browse is up. Density of big sagebrush increased since 1984 from 1,532 to 3,199. Percent decadency has declined from 63% in 1984, to 22% in 1990. Seedlings and young plants are abundant and the population appears to be increasing. Hedging is light on the available shrubs and sagebrush canopy cover averages 11%. The point-centered quarter method estimates 77 junipers per acre, 67% mature trees. The grass component, mainly bluebunch wheatgrass and Sandberg bluegrass, increased significantly in sum of nested frequency and quadrat frequency, while thickspike wheatgrass decreased significantly during this same period.

TREND ASSESSMENT
soil - stable
browse - up
herbaceous understory - up

1996 TREND ASSESSMENT

Trend for soil continues to be stable. Litter cover declined but percent bare ground also went down from 26% to 15%. Trend for browse is stable. Density estimates are similar for mature and decadent plants compared to 1990 data. The number of seedlings and young declined considerably but there are still enough to maintain the population. Use is currently light to moderate and percent decadency slightly higher at 27%. Trend for the herbaceous understory is slightly down. Sum of nested frequency of perennial grasses and forbs declined slightly since 1990. Sum of nested frequency for bluebunch wheatgrass declined significantly while frequency of Sandberg bluegrass remained the same. Five of the forb species encountered in 1990 declined significantly in nested frequency. Since 1984, forb sum of nested frequency has declined with every reading while grasses increased initially then declined slightly.

TREND ASSESSMENT
soil - stable
browse - stable
herbaceous understory - slightly down

HERBACEOUS TRENDS --
Herd unit 01 , Study no: 6

Type	Species	Nested Frequency '84	'90	'96	Quadrat Frequency '84	'90	'96	Average Cover % '96
G	Agropyron dasystachyum	a35	b7	b10	15	2	3	.21
G	Agropyron spicatum	a138	b207	a157	57	85	66	7.69
G	Bromus tectorum (a)	-	-	223	-	-	70	2.32
G	Elymus cinereus	a12	b2	b4	6	1	2	.15
G	Oryzopsis hymenoides	a-	ab1	b8	-	1	4	.09
G	Poa secunda	a54	b145	b145	22	60	56	3.32
G	Sitanion hystrix	a-	a-	b16	-	-	5	.24
Total for Grasses		239	362	563	100	149	206	14.04
F	Agoseris glauca	a-	b17	a5	-	12	3	.01
F	Allium textile	3	-	-	1	-	-	-
F	Arabis spp.	a-	b10	b24	-	6	11	.08
F	Astragalus beckwithii	ab16	a32	b7	7	15	5	.05
F	Astragalus cibarius	a24	b-	b2	14	-	1	.00
F	Balsamorhiza sagittata	11	5	8	7	3	4	.87
F	Caulanthus crassicaulis	-	4	-	-	2	-	-
F	Calochortus nuttallii	-	3	-	-	2	-	-
F	Collomia linearis (a)	-	-	11	-	-	4	.02
F	Comandra pallida	-	4	5	-	2	3	.04
F	Collinsia parviflora (a)	-	-	26	-	-	12	.06
F	Crepis acuminata	a97	b45	c9	46	24	4	.02
F	Cryptantha spp.	a-	a-	b18	-	-	7	.06
F	Delphinium nelsonii	a52	b2	b3	26	1	2	.01
F	Erigeron pumilus	15	10	12	9	6	7	.09
F	Galium aparine (a)	-	-	10	-	-	5	.17
F	Hackelia patens	a-	b23	b17	-	12	8	.26
F	Kelloggia galioides	a47	b-	b-	22	-	-	-
F	Lappula occidentalis (a)	-	-	1	-	-	1	.00
F	Lomatium spp.	6	-	-	3	-	-	-
F	Lomatium triternatum	a15	b1	b-	6	1	-	-
F	Microsteris gracilis (a)	-	-	3	-	-	1	.00
F	Navarretia intertexta (a)	-	-	20	-	-	9	.04
F	Orthocarpus spp. (a)	29	-	-	12	-	-	-
F	Penstemon cyananthus	a-	a4	b79	-	2	39	.43
F	Penstemon spp.	a-	b29	a-	-	16	-	-
F	Penstemon subglaber	3	-	-	2	-	-	-
F	Phlox longifolia	a128	b172	c57	48	72	28	.17
F	Senecio multilobatus	-	-	6	-	-	3	.06

Type	Species	Nested Frequency '84	'90	'96	Quadrat Frequency '84	'90	'96	Average Cover % '96
F	Unknown forb-perennial	-	5	-	-	2	-	-
Total for Forbs		446	366	323	203	178	157	2.48

Values with different subscript letters are significantly different at % = 0.10 (annuals excluded)

BROWSE TRENDS --
Herd unit 01 , Study no: 6

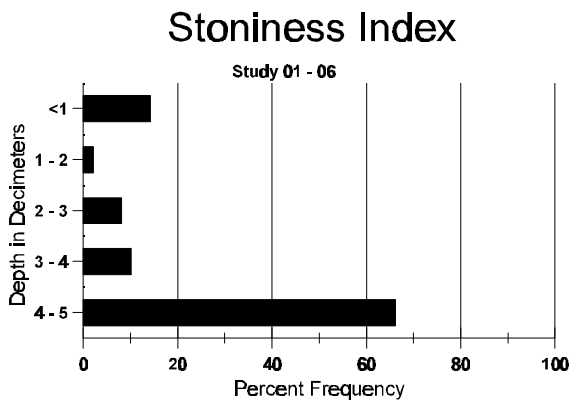
Type	Species	Strip Frequency '96	Average Cover % '96
B	Artemisia nova	35	1.13
B	Artemisia tridentata tridentata	57	4.94
B	Chrysothamnus nauseosus	7	.36
B	Chrysothamnus viscidiflorus stenophyllus	8	.04
B	Gutierrezia sarothrae	8	.04
B	Juniperus osteosperma	3	4.12
B	Opuntia fragilis	1	.00
B	Pinus monophylla	0	.38
B	Purshia tridentata	9	1.57
Total for Browse		128	12.61

BASIC COVER --
Herd unit 01 , Study no: 6

Cover Type	Nested Frequency '96	Average Cover % '84	'90	'96
Vegetation	328	3.50	5.75	31.63
Rock	214	.75	1.00	13.21
Pavement	249	18.00	13.75	6.57
Litter	388	55.00	51.50	39.79
Cryptogams	102	2.00	1.75	1.90
Bare Ground	260	20.75	26.25	15.44

SOIL ANALYSIS DATA --
Herd Unit 01, Study no: 6

Effective rooting depth (inches)	Temp °F (depth)	PH	%sand	%silt	%clay	%0M	PPM P	PPM K	dS/m
17.7	58.5 (17.4)	7.8	36.7	37.0	26.3	2.8	10.1	217.6	.5



PELLET GROUP FREQUENCY --
Herd unit 01 , Study no: 6

Type	Quadrat Frequency '96
Sheep	1
Rabbit	6
Deer	23

BROWSE CHARACTERISTICS --
Herd unit 01 , Study no: 6

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Artemisia nova																		
S	84	13	-	-	-	-	-	-	-	-	13	-	-	-	433			13
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
Y	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	6	1	-	-	-	-	-	-	-	7	-	-	-	140			7
M	84	2	-	-	-	-	-	-	-	-	1	-	1	-	66	10	12	2
	90	1	-	-	-	-	-	-	-	-	1	-	-	-	33	10	9	1
	96	37	18	-	-	1	-	-	-	-	56	-	-	-	1120	10	18	56
D	84	3	1	-	-	-	-	-	-	-	1	-	1	2	133			4
	90	4	-	-	-	-	-	-	-	-	4	-	-	-	133			4
	96	2	3	-	-	-	-	-	-	-	5	-	-	-	100			5
X	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	420			21
Total Plants/Acre (excluding Dead & Seedlings)													'84		199	Dec:		67%
													'90		166			80%
													'96		1360			7%

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Artemisia tridentata tridentata																		
S	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	16	-	-	1	-	-	-	-	-	17	-	-	-	566			17
	96	5	-	-	-	-	-	-	-	-	5	-	-	-	100			5
Y	84	4	-	-	-	-	-	-	-	-	4	-	-	-	133			4
	90	48	-	-	1	-	-	-	-	-	48	1	-	-	1633			49
	96	17	-	-	-	-	-	-	-	-	17	-	-	-	340			17
M	84	8	3	2	-	-	-	-	-	-	10	-	1	2	433	15	11	13
	90	22	3	-	-	-	-	-	-	-	23	2	-	-	833	18	18	25
	96	45	10	-	1	-	-	1	-	-	57	-	-	-	1140	22	28	57
D	84	9	12	7	-	-	-	-	1	-	1	-	10	18	966			29
	90	19	2	-	1	-	-	-	-	-	18	1	1	2	733			22
	96	13	12	3	-	-	-	-	-	-	25	-	-	3	560			28
X	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	1700			85
Total Plants/Acre (excluding Dead & Seedlings)													'84		1532	Dec:		63%
													'90		3199			23%
													'96		2040			27%
Chrysothamnus nauseosus																		
Y	84	1	-	-	-	-	-	-	-	-	1	-	-	-	33			1
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	4	-	-	-	-	-	-	-	-	2	-	2	-	80			4
M	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	96	5	-	-	-	-	-	-	-	-	5	-	-	-	100	20	21	5
Total Plants/Acre (excluding Dead & Seedlings)													'84		33	Dec:		-
													'90		0			-
													'96		180			-
Chrysothamnus viscidiflorus stenophyllus																		
Y	84	2	-	-	-	-	-	-	-	-	2	-	-	-	66			2
	90	4	-	-	-	-	-	-	-	-	4	-	-	-	133			4
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
M	84	2	1	1	-	-	-	-	-	-	4	-	-	-	133	10	15	4
	90	4	2	-	1	-	-	-	-	-	7	-	-	-	233	11	15	7
	96	11	-	-	-	-	-	-	-	-	11	-	-	-	220	12	18	11
D	84	1	-	-	-	-	-	-	-	-	1	-	-	-	33			1
	90	1	-	-	-	-	-	-	-	-	1	-	-	-	33			1
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
Total Plants/Acre (excluding Dead & Seedlings)													'84		232	Dec:		14%
													'90		399			8%
													'96		220			0%

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Gutierrezia sarothrae																		
S	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	14	-	-	-	-	-	-	-	-	14	-	-	-	280			14
Y	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	14	-	-	-	-	-	-	-	-	14	-	-	-	280			14
M	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	96	31	-	-	-	-	-	-	-	-	31	-	-	-	620	5	7	31
Total Plants/Acre (excluding Dead & Seedlings)													'84		0	Dec:		-
													'90		0			-
													'96		900			-
Juniperus osteosperma																		
S	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
M	84	-	-	-	1	-	-	-	1	-	2	-	-	-	66	69	187	2
	90	1	-	-	-	-	-	-	-	-	1	-	-	-	33	236	276	1
	96	3	-	-	-	-	-	-	-	-	3	-	-	-	60	-	-	3
Total Plants/Acre (excluding Dead & Seedlings)													'84		66	Dec:		-
													'90		33			-
													'96		60			-
Opuntia fragilis																		
Y	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	1	-	-	-	-	-	-	-	-	1	-	-	-	33			1
	96	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
M	84	4	-	-	-	-	-	-	-	-	4	-	-	-	133	4	8	4
	90	5	-	-	-	-	-	-	-	-	5	-	-	-	166	6	15	5
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0	5	13	0
Total Plants/Acre (excluding Dead & Seedlings)													'84		133	Dec:		-
													'90		199			-
													'96		20			-
Purshia tridentata																		
Y	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	2	-	-	-	-	-	-	-	2	-	-	-	40			2
M	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	96	3	3	3	-	-	-	-	-	-	9	-	-	-	180	17	39	9
D	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	1	-	1	-	-	-	-	-	-	1	-	-	1	40			2
X	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	120			6
Total Plants/Acre (excluding Dead & Seedlings)													'84		0	Dec:		0%
													'90		0			0%
													'96		260			15%